


# Ten Cloudy Questions


to ask before migrating your SQL Server


*David Klee*





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## About David Klee










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**Specialties / Focus Areas / Passions:**

- Performance Tuning
- Business Continuity
- Virtualization & Cloud
- Infrastructure Architecture
- Health & Efficiency
- Capacity Management



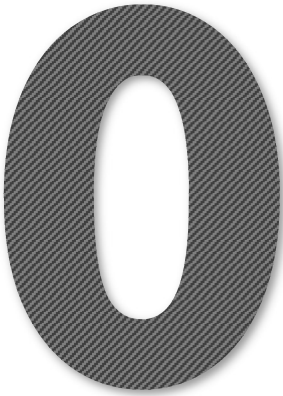
Founder & Technical Exorcist

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what  
**IS**  
the cloud



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**There is no cloud**  
it's just someone else's computer

(image source: <https://nerds.net/the-cloud-frequently-terrible/>)

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## Public Cloud

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- Someone else's datacenter
- Virtualization
- Serious automation
- Self-service
- Applications as-a-service & not just IaaS

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## Service Definitions

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- Infrastructure-as-a-Service (IaaS)
  - SQL Server in an Azure VM
- Platform-as-a-Service (PaaS)
  - Azure SQL Managed Instance
- Database-as-a-Service (DBaaS)
  - Azure SQL Database

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## Major Cloud Players



**Azure**

*(My personal pick because they ... uhh... own the code.)*



**amazon  
web services**



**Google Cloud Platform**



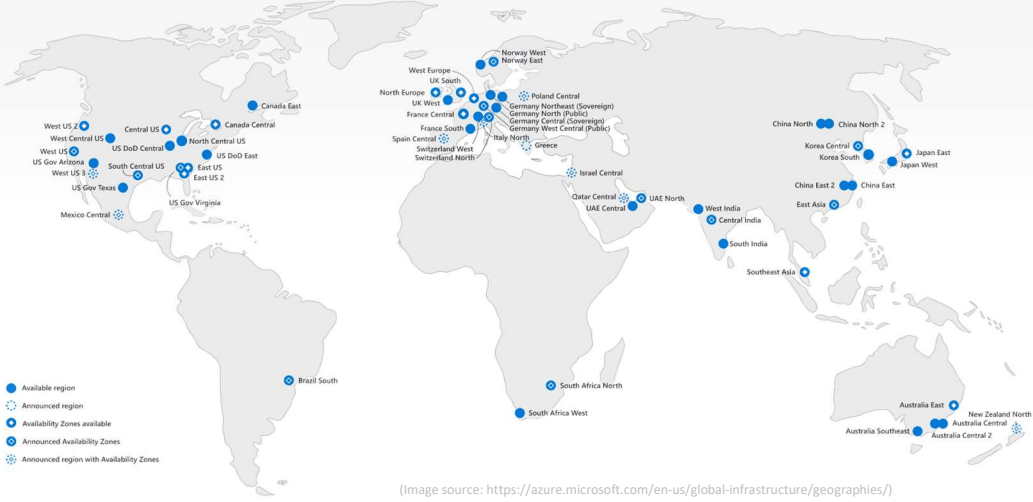
**Alibaba Cloud**

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## Where is the cloud?

- It's on land!



● Available region  
 ○ Announced region  
 ○ Availability Zones available  
 ○ Announced Availability Zones  
 ○ Announced region with Availability Zones

(Image source: <https://azure.microsoft.com/en-us/global-infrastructure/geographies/>)

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why are you  
**CONSIDERING**  
moving to the  
cloud



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## CLOUD!

- NOW!
- Drop everything!
- We're all in!
- Do it!
- GO!
- *Uh-oh.*



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## Why move to the cloud?

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- Did the CEO read about it in a trade mag (SkyMall)?
- Compare & contrast
- Public cloud
- Regional co-lo
- Cloud services
- Great automation

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## Competitive Advantage

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- Does cloud bring competitive advantage?
- Business, not just tech
- Quantify the advantages
- Monetize the advantages

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## Not just a tech change

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- Cloud is not all IT-driven
- Business must be aligned
- Cloud is a *means*, not an *end*
- How to systematically measure the value
- Platform modernization

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## Cloud Migration Myths

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- It's all or nothing
- It's cheaper
- It's "better"
- No maintenance required
- It's easy
- Makes things faster
- Guaranteed available
- Everyone's doing it

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## Cloud Migration Facts

- Flexibility
- Security / data protection / compliance
- Application and data modernization
- Speed of performing IT operations
- Scalability
- Automation
- Efficiency in staff time to manage key systems
- Financial model shift – CAPEX to OPEX
- You're probably not in the datacenter business

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# 2

how do you  
**WANT**  
to use the  
cloud



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## Use Cases

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- Not always “all-in”
- Understand the offerings
- Define strategy before migrations start

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## Off-site storage for backups

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- Start small
- Replicate VMs & DB backups
- Hot / warm / cool standby XaaS
- Usually cheaper than DIY disaster recovery

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## Burst scalability

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- Cloud moves faster than your IT department
- Scale outwards with right app architecture
- Scale to cloud when needed
- Scale back when completed

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## Specific services

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- System integrations
- Data lakes
- Reporting / BI workloads
- Machine learning
- Geo-scale out data (CosmosDB)

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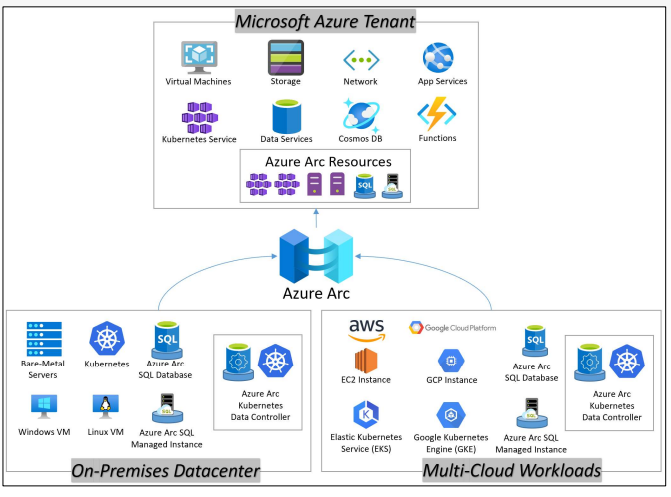
# All-In!

- Done being your own datacenter provider?
- Move everything
- What is *needed* to move everything?
- How will users / apps connect?

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# Azure Arc

- Cloud automation and provisioning
- ...but in your on-premises datacenter
- Single management & telemetry interface
- [azure.microsoft.com/en-us/services/azure-arc](https://azure.microsoft.com/en-us/services/azure-arc)




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3 what cloud database **SERVICES** do you need ?

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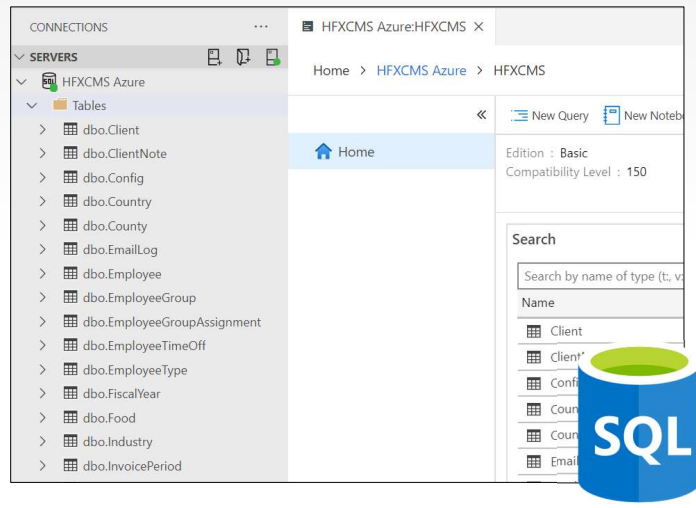
*Just a simple database?*  
*Or just a single instance?*  
*Or all the features & all the management?*

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# Database Services in the Cloud - DBaaS

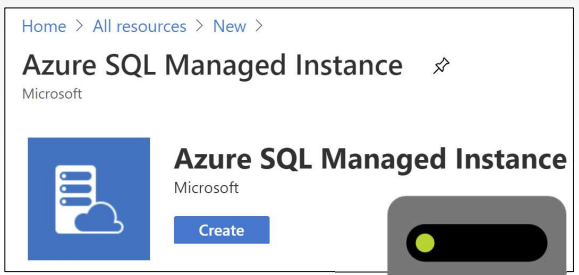
- Azure SQL Database
- Just a database
- No OS, instance access
- Availability & DR
- Criticality Tiers
  - General purpose
  - Business critical



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# Database Services in the Cloud - PaaS

- Azure SQL Managed Instance
- Amazon RDS
- Instance as a service
- Multiple databases
- Agent jobs
- No OS access
- Availability & DR
- Criticality Tiers



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## Database Services in the Cloud - IaaS

- SQL Server in a VM
- Full control
- Business as usual
- You patch it
- You HA it
- Cloud DR is easier... sort of.



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## Backup Replication

```
BACKUP DATABASE ☞ TO  
URL = 'https://hfxstoragebackups.blob.core.windows.net/SQLServerBackups/toiletDB.bak'  
WITH CREDENTIAL = 'AzureBlobCred',  
STATS = 5;
```

- Backup to URL
- Copy FULL/DIFF/TRANLOG backup files to Azure BLOB
- Do not forget system DBs, OSE

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4 what are your **AVAILABILITY** requirements


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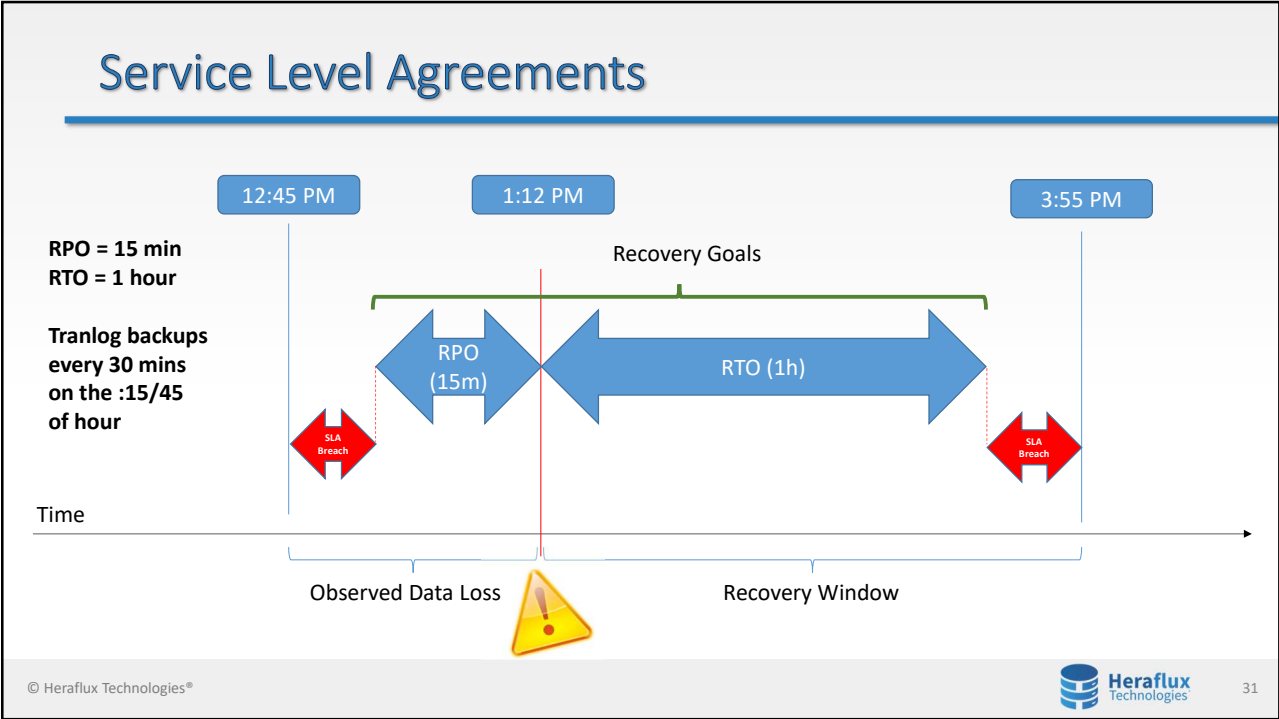
skip the tech

**Recovery Point Objective**  
How much data can we lose?

**Recovery Time Objective**  
How long can this be down?

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## Pick HA / Tier of Service

Home > SQL databases > Create SQL Database >

Configure

Feedback

Looking for basic, standard, premium?

<p><b>General Purpose</b></p> <p>Scalable compute and storage options</p> <p>500 - 20,000 IOPS 2-10 ms latency</p>	<p><b>Hyperscale</b></p> <p>On-demand scalable storage</p> <p>500 - 204,800 IOPS 1-10 ms latency</p>	<p><b>Business Critical</b></p> <p>High transaction rate and high resiliency</p> <p>5,000 - 204,800 IOPS 1-2 ms latency</p>
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Compute tier

<p><b>Provisioned</b></p> <p>Compute resources are pre-allocated Billed per hour based on vCores configured</p>	<p><b>Serverless</b></p> <p>Compute resources are auto-scaled Billed per second based on vCores used</p>
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SQL

- SLAs listed at cloud service provider
- “Business critical” have improved SLAs

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## Availability Targets

- If availability requirements > platform options
- Re-review platform selection choice
- Complement platform HA with your own
- Ex: SQL Server Availability Group inside cloud IaaS
- Otherwise... reduce your expectations?

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# 5

what are your  
**SECURITY**  
requirements



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## Cloud Data Security

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- What sort of data do you have?
- Any compliance required?
  - PCI / HIPAA / SOX / GDPR / etc.
- Who needs access to it?
- Your practices on-premises...
- Can you RTFM?
  - Can you read the **funny** manual?
  - Don't unlock cloud services beyond your needs!

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## Perspectives and Steps

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- On-premises
  - Most things exposed to all other
- Cloud
  - Locked down by default
  - Have to open holes in firewalls
- Should have documented
  - Specific server access requirements
  - Ports too
  - What talks to what?

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how much  
**PERFORMANCE**  
do you  
**NEED**

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## What Are *Your* Servers Consuming?

- Do you have a good baseline?
- Third-Party Utilities
- Perfmon Setup Guide
  - [hfxte.ch/perfmon](https://hfxte.ch/perfmon)
  - No contact info required
- Perfmon BLG to SQL Importer
  - [github.com/heraflux/BLGtoSQL](https://github.com/heraflux/BLGtoSQL)
- Server / Service / VM “Right-Sizing”

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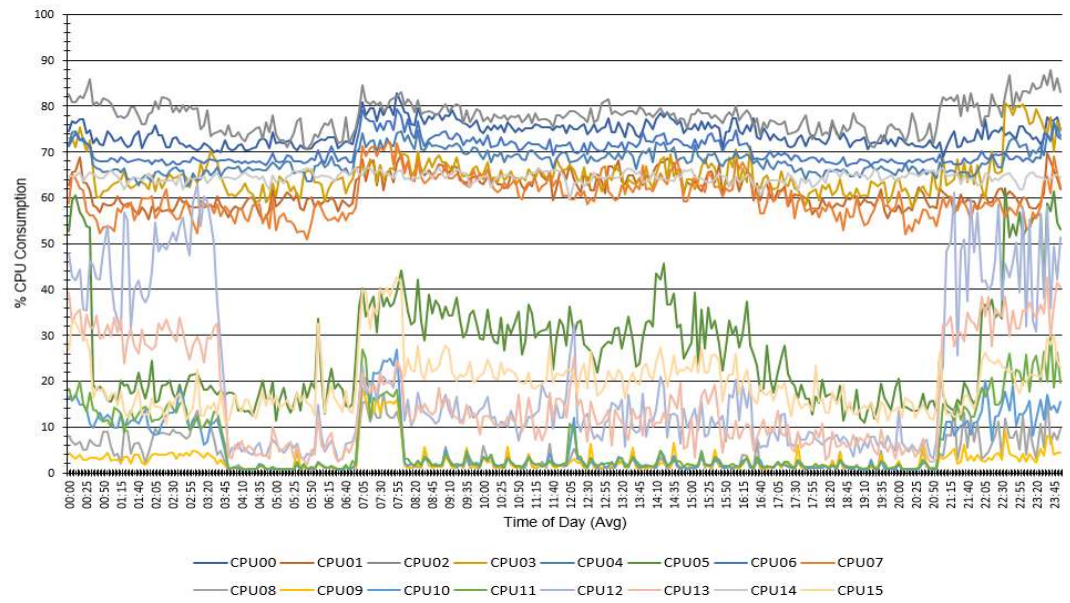
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# Performance KPIs

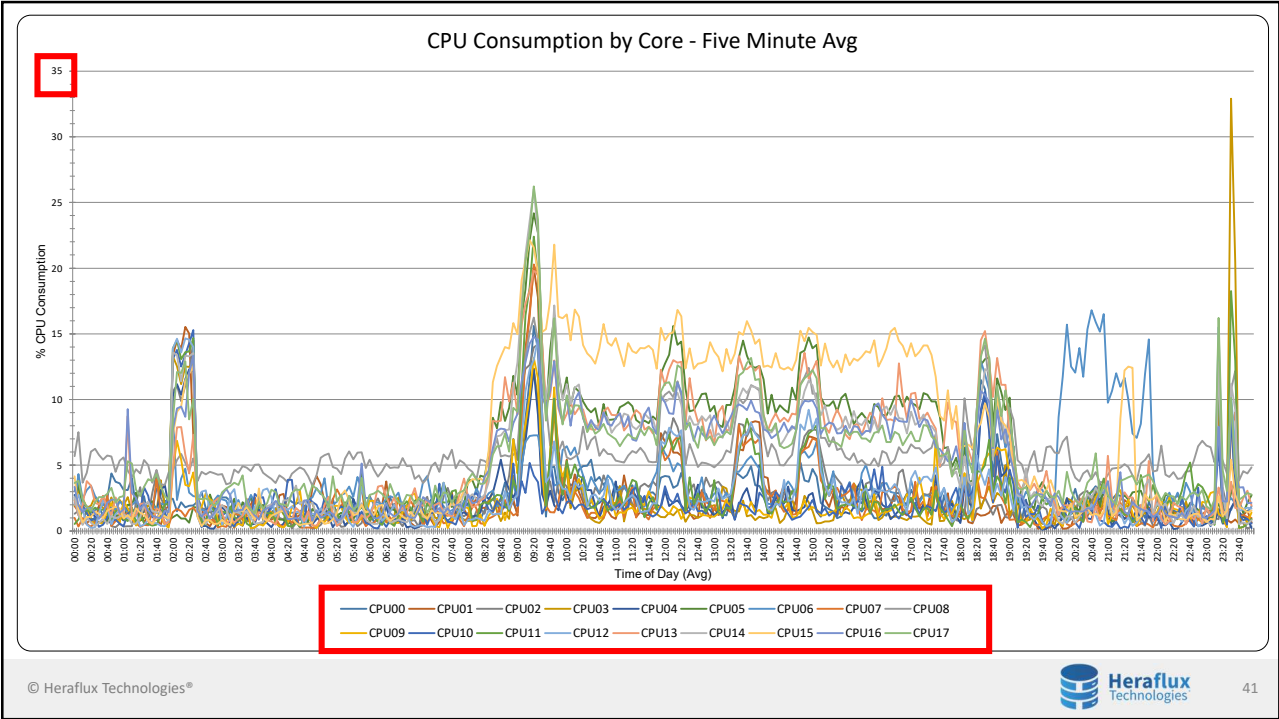
- How much of each resource do you *need*?
- Reasonable collection granularity
- CPU consumption by core
- Memory usage for SQL Server
  - Not OS-level
  - PLE / memory grants pending / buffer cache hit ratio / etc.
- Storage IOPs / throughput

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### CPU by Core - Five Minute Avg



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## Resource Allocations

### Virtual Machines (IaaS)

- You select series (CPU / RAM)
- Attach managed disks

**Virtual Machines**

REGION: West US | OPERATING SYSTEM: Windows

INSTANCE: DS13 v2: 8 Cores(s), 56 GB RAM, 112 GB Temporary storage, \$4.056/hour

D5 v2: 16 Cores(s), 56 GB RAM, 800 GB Temporary storage, \$8.016/hour  
 D11 v2: 2 Cores(s), 14 GB RAM, 100 GB Temporary storage, \$1.764/hour  
 D12 v2: 4 Cores(s), 28 GB RAM, 200 GB Temporary storage, \$2.028/hour  
 D13 v2: 8 Cores(s), 56 GB RAM, 400 GB Temporary storage, \$4.056/hour  
 D14 v2: 16 Cores(s), 112 GB RAM, 800 GB Temporary storage, \$8.111/hour  
 D15 v2: 20 Cores(s), 140 GB RAM, 1000 GB Temporary storage, \$10.139/hour  
 D15i v2: 20 Cores(s), 140 GB RAM, 1000 GB Temporary storage, \$10.139/hour

### DBaaS / PaaS

- vCore model
- RAM is automatic
- Configure storage space needed


INSTANCE: 8 vCore

2 vCore  
4 vCore  
6 vCore  
8 vCore  
10 vCore  
12 vCore  
14 vCore  
16 vCore  
18 vCore  
20 vCore

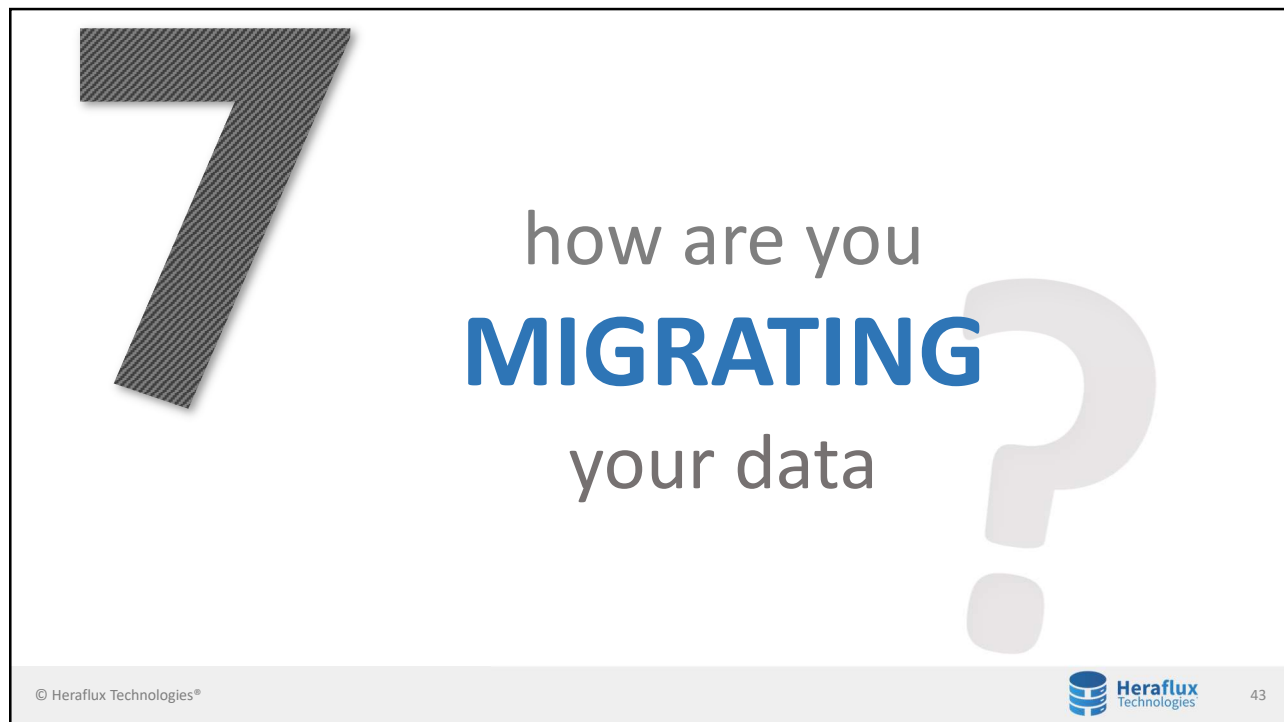
1024 GB

=

\$256.00

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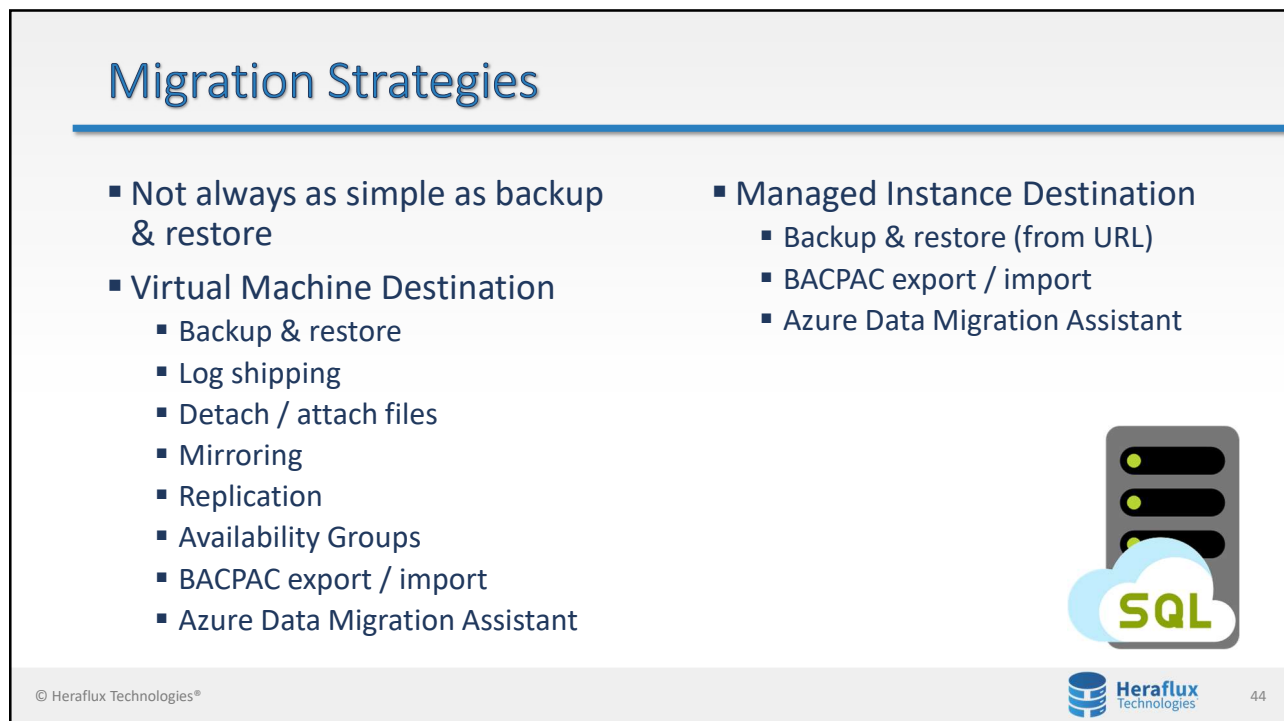
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how are you  
**MIGRATING**  
your data

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## Migration Strategies

- Not always as simple as backup & restore
- Virtual Machine Destination
  - Backup & restore
  - Log shipping
  - Detach / attach files
  - Mirroring
  - Replication
  - Availability Groups
  - BACPAC export / import
  - Azure Data Migration Assistant
- Managed Instance Destination
  - Backup & restore (from URL)
  - BACPAC export / import
  - Azure Data Migration Assistant



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## Migration Strategies

- Azure SQL Database
- BACPAC export / import
- Azure Data Migration Assistant
- Azure Data Migration Services



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## Platform Constraints for Moving Out

- Includes tasks like database refreshes to lower tiers
- Cannot back up from Azure SQL DB to SQL Server
- Cannot back up from Managed Instance to regular SQL Server
  - CAN do this SQL Server 2022+
- Data extraction
  - BACPAC
  - SSIS

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have you validated  
your SQL Server  
**LICENSING**  
needs



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## Existing Licensing

- How are you currently licensed?
- Does your existing licensing transfer?
- Azure Hybrid benefit
  - Migration of servers licensed on-prem to Azure
  - Requires Software Assurance
  - Can also transfer between on-prem VM licensing & DBaaS
- DR-specific licensing clauses

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## Existing Licensing

- Run the numbers ahead of your migration
- Make sure to “right-size” your destination!
- Azure Hybrid benefit
  - Migration of servers licensed on-prem to Azure
  - Requires Software Assurance
  - Can also transfer between on-prem VM licensing & DBaaS
- DR-specific licensing clauses

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have you  
calculated the  
**MONTHLY COST**  
of your  
cloud services



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# Allocation vs. Consumption

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- Cloud myth!
- “Pay for what you use”
- Cloud is partially this model
  - Azure Blob, network throughput, DNS lookups, etc.
- Is partially pay by what you allocate
  - Database IaaS, PaaS, sometimes DBaaS, managed disks, etc.

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# Allocation

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**Service tier**

Select from the latest vCore service tiers available for Azure SQL Managed Instance including General Purpose and Business Critical. [Learn more](#)

Service tier  General Purpose (4-80 vCores, 32 GB-8 TB storage capacity, Fast storage) - for most production workloads

Business Critical (4-80 vCores, 32 GB-4 TB storage capacity, Super fast storage) - for IO-intensive and compute-intensive workloads

**Compute Hardware**

Configure compute hardware that will run your Azure SQL Managed Instance. [Learn more](#)

Hardware generation  Gen5

vCores  8

Storage in GB  256

**Cost summary**

<b>Gen5 BusinessCritical</b>	
Cost per vCore (in USD)	271.80
vCores selected	x 8
Azure Hybrid Benefit discount (in USD)	- 0.00
<hr/>	
Cost per GB (in USD)	0.30
Max storage selected (in GB)	x 256
32 GB storage included (in USD)	- 9.60
<hr/>	
<b>ESTIMATED COST / MONTH</b>	<b>2241.60 USD</b>

**Additional charge per usage**  
See [pricing details](#) for more detail.

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# Cost Estimation (& Savings)

- Factors for sizing
- Estimated CPU consumption (peak & biz hours)
- Memory need
- Storage speed
- Storage space
- Bandwidth
- DR needs
- Azure Calculator
  - [azure.microsoft.com/en-us/pricing/calculator/](https://azure.microsoft.com/en-us/pricing/calculator/)

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### Virtual Machines

REGION: West US | OPERATING SYSTEM: Windows | TYPE: (OS Only) | TIER: Standard

INSTANCE: DS13 v2: 8 vCPU(s), 56 GB RAM, 112 GB Temporary storage | VIRTUAL MACHINES: 1 x 730 Hours

LICENSE: SQL Standard

**Monthly cost \$1,528.48**

### Savings Options

Save up to 72% on pay-as-you-go prices with 1-year or 3-year Reserved Virtual Machine Instances. Reserved Instances are great for applications with steady-state usage and applications that require reserved capacity. [Learn more about Reserved VM Instances pricing.](#)

<b>Compute (DS13 v2)</b> <input checked="" type="radio"/> Pay as you go <input type="radio"/> 1 year reserved (~38% discount) <input type="radio"/> 3 year reserved (~59% discount) \$540.93 Average per month (\$0.00 charged upfront)	<b>OS (Windows)</b> <input checked="" type="radio"/> License included <input type="radio"/> Azure Hybrid Benefit \$229.95 Average per month (\$0.00 charged upfront)	<b>= \$770.88</b> Average per month (\$0.00 charged upfront)
<input type="checkbox"/> Managed Disks \$153.60 <input type="checkbox"/> Storage transactions \$20.00		
		<b>Upfront cost \$0.00</b> <b>Monthly cost \$944.48</b>

LICENSE: SQL Enterprise

**Monthly cost \$3,134.48**

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# “Serverless”

Looking for basic, standard, premium?

**General Purpose**  
Scalable compute and storage options  
500 - 20,000 IOPS  
2-10 ms latency

**Hyperscale**  
On-demand scalable storage  
500 - 204,800 IOPS  
1-10 ms latency

**Business Critical**  
High transaction rate and high resiliency  
5,000 - 204,800 IOPS  
1-2 ms latency

**Compute tier**

**Provisioned**  
Compute resources are pre-allocated  
Billed per hour based on vCores configured

**Serverless**   
Compute resources are auto-scaled  
Billed per second based on vCores used

**Compute Hardware**  
Click "Change configuration" to see details for all hardware generations available including memory optimized and compute optimized options

**Hardware Configuration**

Gen5

up to 40 vCores, up to 120 GB memory  
[Change configuration](#)

**Max vCores**

1 2 4 6 8 10 12 14 16 18 20 24 32 40

8 vCores

**Min vCores**

1 1.25 1.5 1.75 2 2.25 2.5 3 4 5 6 8

2 vCores

**Cost summary**

**Gen5 - General Purpose (GP\_5\_Gen5\_8)**

Cost per GB (in USD) 0.12

Max storage selected (in GB) x 41.6

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**ESTIMATED STORAGE COST / MONTH 4.78 USD**

**COMPUTE COST / VCORE / SECOND<sup>1</sup> 0.000145 USD**

**NOTES**  
<sup>1</sup> Serverless databases are billed in vCores based on a combination of CPU and memory utilization. [Learn more about serverless billing](#)

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# Service Times

- “Serverless” option
- Shuts down after X time
- Billed for compute while on
- Billed for storage 24x7
- Save \$\$\$

REGION: East US

TYPE: Single Database

BACKUP STORAGE TIER: RA-GR5

PURCHASE MODEL: vCore

SERVICE TIER: General Purpose

COMPUTE TIER: Serverless

GENERATION: Gen 5

**Billed vCores**

Maximum vCores: 4      Minimum vCores: 0.5

CPU Used (vCores) 0.75      Memory used (GB) 4.85      Duration (in seconds, max 2,678,400 seconds (744 hours)) 800000

Minimum memory 2.10 GB

Maximum memory 12.00 GB

Billed vCores 1.62      = \$187.45

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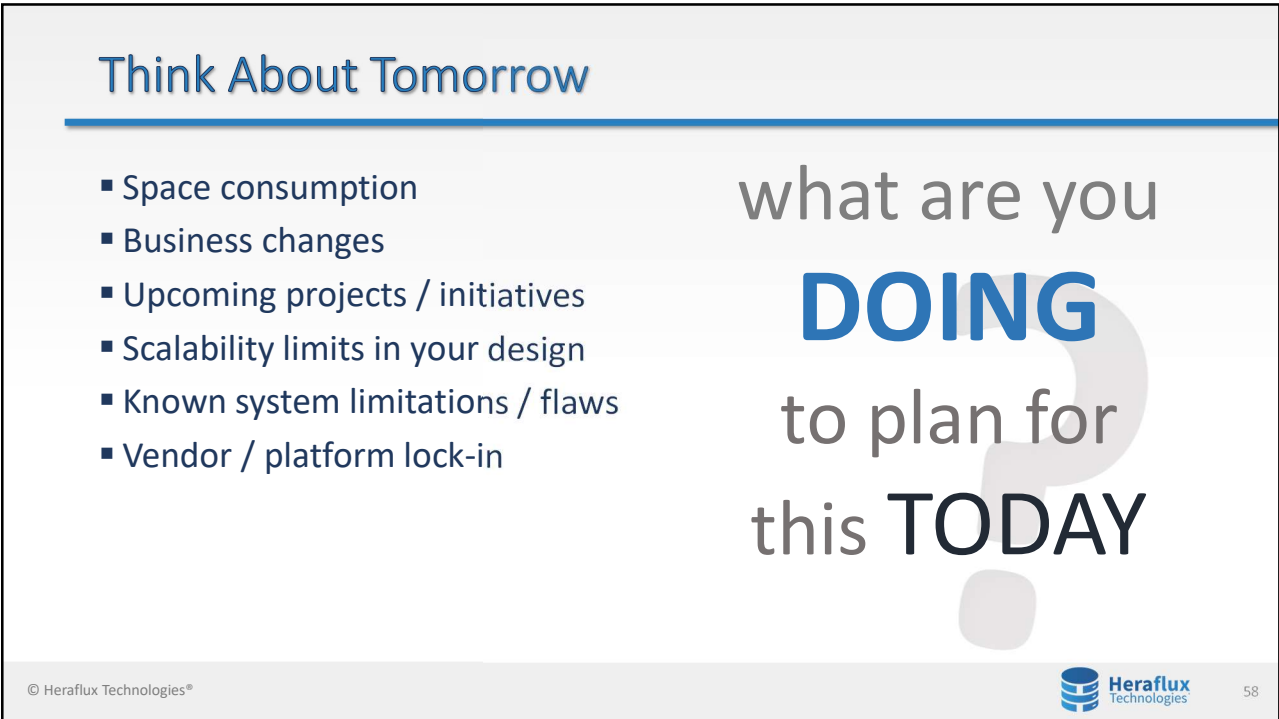


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what are your  
**FUTURE**  
needs

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Think About Tomorrow

- Space consumption
- Business changes
- Upcoming projects / initiatives
- Scalability limits in your design
- Known system limitations / flaws
- Vendor / platform lock-in

what are you  
**DOING**  
to plan for  
this **TODAY**

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## Put It All Together

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- Cloud is a great tool in your toolbox
- It is not the ONLY tool
- Migrate services for real reasons
- Choose your path wisely
- Understand your cost model
- Plan for the future

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## Questions?

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 heraflux.com  
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Thanks for attending!



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